General

Guideline Title

HealthPartners Dental Group and Clinics caries guideline.

Bibliographic Source(s)

HealthPartners Dental Group and Clinics caries guideline. Minneapolis (MN): HealthPartners Dental Group; 2013 Dec. 69 p. [374 references]

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: HealthPartners Dental Group and Clinics caries guideline. Minneapolis (MN): HealthPartners Dental Group; 2008 Mar 31. 60 p. [328 references]

Recommendations

Major Recommendations

Caries Risk Assessment

Overview

Identifying and assessing groups and individuals at high risk for developing new dental caries allows determination and development of appropriate and effective prevention strategies. Caries risk assessment is an emerging, developing science. Various methods for assessing risk exist, and no single model is better at predicting risk. Methods that take multiple factors into account achieve greater accuracy for predicting risk of dental caries. In the clinical setting, careful consideration was given to time constraints. Therefore, this guideline avoids collecting data on risk factors that do not significantly improve risk assessment. Caries risk assessments systematically considers the patient's health practices and oral conditions.

Populations at increased risk of dental caries are members of families of low socioeconomic status (SES) or low levels of parental education; those seeking dental care on an irregular basis; and persons without dental insurance or access to dental service. Persons can be at high risk of dental caries even if they do not belong to a high-risk group; individuals can be a low risk of caries, even if they belong to a high-risk group.

Individual level factors thought to contribute to increased risk are:

- Active dental caries
- Recent caries
- Caries experience in siblings or caregivers
- Exposed root surfaces
- High levels of infection with cariogenic bacteria

- Impaired ability to maintain oral hygiene
- Malformed enamel or dentin
- Inadequate exposure to fluoride
- Reduced salivary flow due to medications or disease
- Head and neck radiation treatment
- Low salivary buffering capacity (decreased ability of saliva to neutralize plaque acids)
- A diet conducive to dental caries (i.e., high in refined carbohydrates that are consumed frequently throughout the day)
- Wearing space maintainers
- Orthodontic appliances or dental prostheses

Caries experience in the last 2 to 3 years is the single best predictor of future disease but the results can change by considering other factors. For children, caries in their primary teeth increases the risk of developing caries in their permanent teeth (relative ratio=2.6, 95% confidence interval [CI]=1.4–4.7; p <0.001). Caries on primary molars is most predictive.

Caries is a bacterial disease with multiple factors that affect the ability for the bacteria to produce the disease. Mutans streptococci (MS) and lactobacillus (LB) are the bacteria associated with dental caries. Recent research has shown caries can develop in the absence of MS and that low pH non-MS may also be cariogenic. Actinomyces have been shown to be involved in root caries.

The risk for disease can change over time. Other factors besides past caries experience need to be considered in assessing future caries risk.

Diet

Diets high in refined carbohydrates and frequent exposures to refined carbohydrates increases the future risk of caries. However, no reliable quantitative data exists that can be used to assign risk based on dietary analysis. Diets that have frequent exposures to refined carbohydrates create an increased risk of caries. Asking about the frequency and types of snacks, lozenges, or beverages is the suggested approach for diet assessment. If active caries is present, this dietary screening will lead to an intervention focused on dietary change. Dentists also want to screen for a new dietary habit that may put the patient at an elevated risk in the future. If a habit of frequent sugar consumption during the day has recently developed, the dentist might consider placing the patient at a higher risk level until the behavior is altered (see Appendix 5 in the original guideline document).

Plaque Control Record

A plaque control record does not help dentists assign risk because they do not know what types of bacteria are present. A plaque control record is helpful as a tool to measure patients' efforts and effectiveness at home plaque removal, but not as a predictor of future disease.

Bacterial Tests

Simple in office tests are available to measure the presence of MS and LB in saliva. These tests have several limitations, especially when dealing with a multifactor disease. Having the bacteria without other factors does not result in caries. Also, studies have shown that caries can be initiated in the absence of MS. Therefore bacterial tests are not recommended at this time to assess caries risk. The tests may be helpful at monitoring patient compliance than predicting caries.

Xerostomia

Patients with xerostomia due to head and neck radiation therapy or Sjogren's syndrome should be considered at high risk of future caries. Also, patients who are taking medications with a known side effect of xerostomia should be considered at an elevated risk. Subjective complaints are not reliable. Examining the mouth for dryness of the tissues is helpful. Unstimulated salivary flow appears to have more impact on remineralization potential for root surface caries than stimulated saliva. Sialometric methods are cumbersome.

The following questions are recommended:

- Does your mouth feel dry when eating a meal?
- Do you sip liquids to aid swallowing any foods?
- Do you have difficulty swallowing any foods?
- Does the amount of saliva in your mouth seem to be too little, too much or you do not notice it?
- Is your speaking ability affected?

The dentist should consider the following factors when evaluating the patient's answers:

- Do you notice clinical signs (such as dry lips)?

- Does the mouth mirror stick to the oral mucosa?
- Is there a lack of a pool of saliva in the floor of the patient's mouth?
- Is there difficulty expressing saliva from the major salivary ducts?
- Does the mucosa appear dry?
- Is there an increase in caries in an unusual location (example: mandibular incisors)?
- Does the patient have any systemic condition?
- Is the patient taking medications with known xerostomic side-effect?
- Has the patient received or will the patient receive radiation of the head and neck?
- Does the patient have sufficient hydration?

Localized Areas at Greater Risk

Caries risk assessment should also consider localized areas at greater risk. For example, children experience caries more commonly on surfaces with pits and fissures. Areas of open margins or overhangs are also at greater risk. Older individuals with gingival recession experience more root caries. The preventive strategy used should consider the areas at greatest risk for future caries. Placement of orthodontic bands or low levels of fluoride in a child's drinking water also increase caries risk. These factors are not good predictors of future caries but they do tell us something about host susceptibility. If host susceptibility is elevated, the dentist may consider increasing the risk level and/or apply specific preventive interventions such as sealants that can reduce risk.

Caries History

The best predictor of future disease is past disease. Dentists can look at past disease in 2 ways:

- Collective lifelong experience
- Recent experience

Recent caries experience is defined as the number of caries lesions in the last 3 years. Dentists can look at a lifelong caries experience when data on recent caries experience is not available. Tracking decayed, missing, and filled teeth is a way to measure the patients collective caries experience. This overall experience should take the age of the patient into consideration.

Caries Risk Assessment by Age

HealthPartners Dental Group (HPDG) dentists and staff have the opportunity to reduce caries in children by applying a systematic program of evaluation, risk assessment, and intervention of children for dental caries. The first step in this process is the oral evaluation/examination of the patient as early as possible. Current recommendations suggest that a child should have their first oral evaluation/examination no later than their first birthday. This oral evaluation/examination can be accomplished by means of a knee-to-knee examination involving the caregiver or with the caregiver seated in the dental chair holding the child crosswise in the lap. Either method allows the caregiver to visualize the oral examination and to assist in careful restraint of the child's arms and legs.

After assessing the child's dental caries risk, the dentist can recommend appropriate interventions. Most children will be in the low-risk category and require only an initial oral debridement with a toothbrush. The use of a disclosing agent will afford the opportunity to assess oral hygiene skills and the need for instruction and assist in supporting the suggested recall interval. Following the oral debridement, the application of a fluoride varnish using a disposable brush is equal to or more effective and less time consuming than the traditional application of a fluoride gel using disposable trays. For low-risk children, the recommended recall interval can be 12 months.

For high-risk children, the same procedures will be used, but the child will be appointed for additional interventions, therapeutic treatments, or more frequent fluoride varnish application.

Protocol: Primary and Transitional Dentitions

1. The dentist is the primary provider for the very young child. For the older child the dental assistant or dental hygienist would be the primary provider. Greet the caregiver, introduce yourself, and ask the caregiver if they have any current oral health concerns regarding their child and determine if the home water comes from a well.
2. Invite the caregiver to accompany the child to the examination area.
3. Inform the caregiver about the new evidence-based knowledge regarding dental caries, cavitated lesions, and concepts for preventive interventions.
4. Depending on the size and compliance of the preschool child, the dentist can use a knee-to-knee positioning technique, have the caregiver sit in the dental chair and hold the child in his/her lap, or have the child sit in the dental chair. For the older child, have the patient sit in the

dental chair and invite the caregiver to observe.

5. The dentist will perform an oral assessment to assist in formulating a risk assessment. Observe for the presence of dental restorations, cavitated enamel lesions, and/or demineralized enamel. In addition, observe for visible plaque and oral pathology. Depending on the compliance of the child, perform a complete head and neck examination. For the older child, use a disclosing solution to assist in caregiver oral hygiene education.
6. Using the HPDG risk assessment protocol, the dentist will perform a risk assessment.
7. If low-risk, inform caregiver of the child's current risk assessment, provide information on oral hygiene and diet, perform a toothbrush prophylaxis using toothpaste only. Recommend a 1-year recall interval.
8. For the very young child at moderate- or high-risk, the dentist will inform caregiver of the child's current risk assessment, provide information on oral hygiene and diet, perform a toothbrush prophylaxis using fluoride toothpaste, and apply fluoride varnish using a microbrush. Recommend a 3 to 6 month recall interval. If cavitated enamel lesions require restoration, appoint for restorative procedures or refer to a pediatric dentist. Review the Personal Dental Care Report (PDCR) with the parent or caregiver and provide written copy. Caregiver education regarding necessary behavioral changes is critical for risk-level change.

For the older child at moderate- or high-risk, the dentist will inform the caregiver of the child's current risk assessment and provide information on oral hygiene and diet. The dental assistant will perform a toothbrush prophylaxis using fluoride toothpaste and apply fluoride varnish using a microbrush. A 3 to 6 month recall is recommended. Casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) can be used to assist in remineralization. If cavitated enamel lesions require restoration, appoint for restorative procedures. Review the PDCR with the parent or caregiver and provide written copy.

Protocol: Permanent Dentition

1. The dental hygienist is the primary provider. Greet the patient, introduce yourself and ask the patient if they have any oral health concerns.
2. Radiographs are taken per dentist orders in electronic dental records (EDR) or in compliance with the Collaborative Agreement.
3. Patient is escorted to the treatment room and the medical and dental histories are reviewed and entered into EDR. For patients 18 years and older, blood pressure is taken and recorded in the health history.
4. For patients new to HPDG, existing restorations are recorded in EDR. Full mouth periodontal probings are recorded for all patients 18 years and older. For patients under the age of 18, periodontal probing should be conducted if the radiographs suggest bone loss. Obvious findings can be discussed with the patient as a primer for the dentist's examination.
5. The dentist is advised that an exam can now be conducted on the patient. The dentist reviews the patient's history, radiographs and periodontal recordings. The dentist then conducts a detailed soft and hard tissue examination relaying any findings to the dental hygienist to record in EDR.
6. Based on the findings in the examination, the dentist determines caries, periodontal and oral cancer risk levels and advises the patient of these levels. This information, along with recommended interventions is recorded in EDR under the risk tab. Recall intervals for dental hygiene and dentist examination visits are established along with any orders for new radiographs. A treatment plan for periodontal therapy and/or restorative care is developed, if indicated.
7. The dental hygienist discusses risk factors along with recommended interventions in detail with the patient as the hygiene visit continues. The patient is given a copy of the Personal Dental Health Risk Summary at the end of the appointment.

Radiologic & Clinical Examination for Dental Caries

Dentistry has, until recently, given little attention to improving the accuracy of the diagnosis of caries. To adopt a medical model of caries treatment dentists must first learn to diagnose and treatment plan with a current understanding of the caries disease process. To practice dentistry in this new way we must be able to reliably identify caries lesions at a threshold that allows for medical intervention versus surgical therapy.

Caries diagnosis is much more than identification of a lesion. Dentists must also determine if the lesion is active, inactive or remineralized. Much of the focus has been on detection of the very early lesion but this has the potential for over treatment. Unnecessary restoration has long term consequences for the tooth. Dentists are only interested in restoring the teeth where remineralization is unlikely to be effective.

Caries can be defined as the earliest microscopic signs of disruption of the hydroxyapatite crystals of enamel. Caries is defined differently in different settings. The extent of demineralization described as caries is defined as the diagnostic threshold. With the use of the medical model the diagnostic threshold for caries should be the earliest sign of the disease long before restoration is indicated.

Current evidence supports remineralization of early, non-cavitated lesions. A norm in dental treatment is to treat proximal decay when it extends into the dentin radiographically, other smooth surface lesions when cavitation is demonstrated or when the surface can be penetrated by a sharp explorer and occlusal caries when there is a stick with a sharp explorer. Currently there is evidence that proximal lesions into dentin may not progress or progress very slowly, that some smooth surface lesions might best not be restored, and that a sharp explorer has no place in examining

for primary occlusal caries. Keep in mind that an explorer will stick in any crevice, carious or not. Changes in color and translucency may also be observed through enamel.

Clearly there is a risk for delaying intervention until after the tooth has been compromised. Also restorations in themselves can place a tooth at greater risk if performed when not necessary. A balance must be struck between the risk of continued caries penetration, and the risk posed by restoration. Demonstrating progression through consistent radiography and clinical examination principles is a challenge, as is the monitoring and treatment of unrestored caries lesions. Progression of the caries lesion that is not responsive to remineralization therapy is a criterion for surgical treatment.

Wide exposure to fluoridated dentifrice over the past 30 years has resulted in a change in the incidence, presentation and progression of caries in industrialized countries. The risk of over treatment of a slow progressing disease should be considered. Also consider carious lesions to penetrate dentin while leaving the enamel intact. Cavitation alone is an insufficient criterion for the need for restoration. Occlusal caries have not had the reduction in incidence that has been seen with proximal caries. Sealants both help prevent occlusal caries but also complicate the detection of caries by obscuring the occlusal surface.

Bite-wing (BW) films at 6 or 12 month intervals for proximal decay detection in all patients, external light and a sharp explorer provided the armamentarium. This is changing. Keep in mind that caries progression is slow in populations with adequate oral hygiene. It takes up to 4 years for caries to progress through enamel in patients with normal oral hygiene using fluoride toothpaste.

New Directions in Caries Diagnosis

Occlusal Caries

Caries researchers recommend against using a sharp explorer when examining pits and fissures. Histological evidence shows the explorer can disrupt incipient caries and bacteria can be moved from groove to groove by a sharp explorer. Reliance on a sharp explorer has the potential to underutilize other detection methods and leads to a false positive diagnosis of occlusal caries.

Visualization of pit and groove areas for discoloration under the enamel is essential for pit and fissure diagnosis. Teeth must be clean, dry, and well illuminated to be properly evaluated. With the greater exposure to fluorides and more frequent placement of sealants deep caries can exist without a visible indication. Radiographs, in the past considered of limited use in the detection of occlusal caries, have been shown to be valuable in detecting deep dentin caries beneath pit and fissures and sealants.

Proximal Caries

Proximal radiographs provide a good representation of caries in enamel and dentin. When exposed with consistent angulation radiographs can provide an indication of whether a lesion is progressing. Film holding devices are valuable in producing consistent radiographic exposures, and should be used whenever possible. Visualization of the tooth looking for clinical cavitation and marginal ridge discoloration is an important adjunct to radiographic examination. Transillumination of the tooth is a valuable adjunct when recent films are not available, but provides limited additional diagnostic yield beyond that afforded by a radiograph. An evaluation of risk is a required part of the prescription of a radiographic recall interval.

The radiographic examination recommendations presented are based on the U.S. Food and Drug Administration (FDA) recommendations found in Guidelines for Prescribing Dental Radiographs (see Appendix 2 in the original guideline document). This guideline was developed by a panel of experts to optimize patient care by presenting patient selection criteria based on signs, symptoms, and history of the individual patient, rather than using the "routine" intervals that have historically been the norm for prescribing dental radiographs. The recommendations are meant only as a guide and may be customized by the dentist to satisfy the individual needs of the patient in a given situation. As an example, specific monitoring of an early carious lesion would be appropriate at other intervals.

As the patient's caries risk level increases, the need for timely clinical dental examination increases. As the patient complies with prescribed treatments and interventions (fillings, sealants, chlorhexidine [CHX], fluoride, diet modification, etc.), they should move to a lower caries risk level. Over time the patient would be less likely to develop new or recurrent dental caries, thus the clinical dental exam interval could be lengthened.

Using criteria based on the caries risk level helps to ensure that patients will not be exposed to unnecessary ionizing radiation and that the radiographs taken will have significant diagnostic value. Intervals for clinical examination are lengthened as the dentist has gathered information that indicates the caries risk is reduced.

When a caries lesion is identified, it should be further categorized it by depth, progression (progressing or not progressing) rate of progression, and whether the lesion is cavitated or non-cavitated. A lesion is amenable to remineralization if it has not progressed more than a third of the way into the dentin, is non-cavitated (organic matrix is intact), and is slow progressing. Recurrent caries around restorations is not amenable to remineralization and the restoration should either be repaired or replaced.

Determining whether a lesion is cavitated can be difficult if the surface enamel is intact but a darker more opaque appearance to the lesion often indicates cavitation. Depth is best monitored by BW radiographs. Periodic radiographs are often necessary to monitor whether the lesion is progressing over time. Note that a lesion can take 3 or more years to progress depending on other factors. Lesions must be monitored over time to determine if they have progressed (demineralization), remineralized or arrested. Progressing enamel caries typically have a chalky appearance, with none of the sheen that characterizes an undisturbed or remineralized surface.

Studies conclude that both radiographic and clinical examinations are necessary for accurate diagnosis of dental caries. As the caries risk level for a patient moves toward low risk, the indicated frequency for radiographic and clinical examination decreases. Conversely, as the patient moves toward high caries risk level, the need for radiographic and clinical examination increases. The recommendations presented are based on the need for caries diagnosis only.

Early (Incipient) Caries

Diagnosis of small lesions and non-cavitated demineralized areas presents a particularly difficult challenge for the dentist. Current diagnostic methods are relatively insensitive for this purpose. Determination of the patient's caries risk based on past caries experience and current lifestyle factors is the logical first step in the diagnostic process. Properly exposed radiographs can detect proximal lesions that are only one third of the way through the enamel. Use of rectangular collimation and a film holding device can be beneficial by reducing the penumbra effect and providing a consistent exposure angle. Digital radiographic techniques may also improve the detection of early caries since the images acquired are digital and can be processed or analyzed to enhance diagnostic performance.

Careful visual inspection of well-dried tooth surfaces is useful in detecting discolored and demineralized areas of enamel and cementum. Incipient enamel caries lesions look whiter than the surrounding sound enamel because of the strong scattering of light within the lesion. Use of magnification can be especially helpful in assessing the integrity of the tooth surface.

Diagnosis of early root caries presents a difficult challenge for the dentist. Texture is the best method to determine root caries activity. When judging texture, the explorer is held with a light grasp and the tip is moved across the surface. Avoid forceful poking into the surface to determine consistency. The literature consistently supports that discoloration of the root surface is indicative of caries. Yellow or light brown color is generally active. Shiny and dark is generally inactive. Radiographs are useful in detecting interproximal root surface lesions. As root caries can progress at a rapid rate, early identification is critical if remineralization strategies are to be successful.

Emerging Diagnostic Techniques

There are several emerging diagnostic techniques that appear to offer some promise in the detection of early dental caries:

> *Fluorescence*
>
> Fluorescence from laser light can be used to detect the difference between sound and demineralized enamel. The two products available are DIAGNOdent and quantitative light-induced fluorescence (QLF)-clinic. These systems have good positive predictive value (PPV) and negative predictive value (NPV) in high-risk populations, but unacceptably large numbers of false positives are possible in moderate- and low-risk populations. Concerns center around the confounding effects of stain, plaque and fluorosis on lesion depth. Further research is needed to address these and other concerns. They may be valuable in assessing progression.
>
> *Fiber-Optic Transillumination*
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> Fiber-optic transillumination (FOTI) has sufficient evidence to support its uses for detection of interproximal lesions.
>
> *Digitally Imaging Fiber-Optic Transillumination*
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> Digitally imaging fiber-optic transillumination (DIFOTI) is a more recent development that combines FOTI with a digital intraoral camera. The images are displayed on a computer screen where it can be compared to the clinical presentation. Only limited in vitro studies are available to support this approach even though it is commercially available.
>
> *Electrical Conductivity*
>
> Electrical conductivity tools have been developed for clinical use to detect occlusal caries. They show high sensitivity but low specificity resulting in significant risk of over treating.

No single caries detection method can be used on all surfaces under all circumstances. If the goal is monitoring interproximal lesions without radiographs, FOTI or DIFOTI are appropriate. QLF is also well suited to monitor lesions. These tools should be used only as an adjunct to clinical decision making regarding preventive treatment plans in conjunction with caries risk assessment. Their value is in early caries diagnosis and

care should be exercised in order to avoid premature restorations of caries lesions.

Remineralization Therapy

Overview

The scientific evidence demonstrates that early caries lesions can be remineralized. This is achievable if the lesion is non-cavitated and adequate fluoride is available at the tooth surface. Factors such as bacterial load and frequent exposure to carbohydrates, that demineralize the tooth, need to be modified. Fluorides are considered to be the primary treatment for remineralization (see Figure 4 in the original guideline document).

Diagnostic Criteria for Active Versus Inactive Carious Lesions

Interproximal

No change on a radiograph in 3 years is considered inactive.

Smooth Surface

- Chalky white is active
- Shiny white is inactive

Root Surface

- Yellow or brown color and soft is active
- Shiny and dark is inactive

Fluoride Therapy Based on Caries Location

The location of the carious lesion often dictates the preferred fluoride vehicle. The compliance of the patient may also influence the choice of fluoride. The success of the procedure is thought to be related to the frequency that the fluoride is applied, so patient adherence to the regimen is critical.

Root Caries

For incipient lesions, utilize a high dose fluoride gel or paste applied by the patient 2 times per day. At all clinic visits (including hygiene and restorative) a fluoride varnish should be considered.

Interproximal Caries

For all incipient lesions no deeper than the dentino-enamel junction (DEJ) utilize frequent low-dose fluoride 4 to 6 times per day. Utilize fluoride rinses and toothpaste at strategically planned intervals throughout the day. At all clinic visits (including hygiene and restorative) a fluoride varnish should be considered.

Other Smooth Surface Caries

Frequent low-dose fluoride (rinses and over-the-counter [OTC] toothpaste 4 to 6 times a day is the best approach). For low compliance patients add in a fluoride varnish every 3 months. At all clinic visits (including hygiene and restorative) a fluoride varnish should be considered.

Pits and Fissures

Morphology of the pits and fissures do not lend themselves to remineralization therapy. Sealants are the treatment of choice (see the "Sealant" section in the original guideline document).

Additional Therapies

Diet Modification

Diet modification is important in remineralization. The key goal is reduction of between meal snacks and beverages that are caries promoting.

Chlorhexidine

CHX rinse has been shown to be effective in reducing MS counts in the mouth. However, although CHX may temporarily reduce MS in the oral cavity, clinical studies fail to show a statistically significant reduction in coronal caries with use of any CHX delivery system. The 1:1 mixture of

CHX-Thymol varnish may be effective at reducing the incidence of root caries.

Xylitol

Xylitol gum or mints are indicated for individuals with dry mouth, frequent snacking, gum or candy use. Xylitol can significantly reduce caries progression if used for 5 minutes 3 to 4 times a day after meals and snacks. Look for products where xylitol is the primary sweetener. Xylitol products have been shown to retard bacterial growth after CHX therapy. Ideally, at least 5 to 8 grams of xylitol should be consumed daily.

Casein Phosphopeptides-Amorphous Calcium Phosphate

CPP-ACP is indicated for patients with high caries rates. Ideal application utilizes custom made fluoride trays. Exposure for 4 to 5 minutes after normal home care before bed (and ideally a second time during the day) is most beneficial. Since it is safe to swallow in the format without fluoride, Australian practitioners have recommended a pea sized amount be placed on teeth before patient goes to sleep. This would not be removed and allowed to work while the patient is sleeping. This technique has also been suggested for pediatric patients although some research found limited added benefit to the application of CPP-ACP in pre-school children in comparison to the application of fluoride toothpaste alone. CPP-ACP is very useful in remineralization efforts in those with xerostomia (where saliva with the necessary minerals is lacking).

Avoid using this with patients allergic to milk products.

Monitoring Interval

Individuals with several risk factors for progression, evidence of rapid progression or concerns about compliance, and patients new to HealthPartners should be seen at 3 to 6 month intervals. Six-month follow-up is indicated for patients established in the practice with prior radiographs and no evidence of rapid progression. For patients where the lesion has not progressed in 3 years, a 1-year follow-up interval may be indicated.

Radiographs are typically the best method to evaluate interproximal lesions that cannot be visualized directly. A BW radiograph is recommended every 6 months for the first 2 years and yearly thereafter if the lesion has not progressed.

Maintenance

Successful remineralization therapy is generally defined as no progression in 3 years. Thereafter the recall intervals and radiograph intervals should be based on the patient's risk level. Caries interventions for the maintenance stage should be based on the overall caries risk. For example, discontinue remineralization therapy for the person who has significantly improved their dietary pattern and oral hygiene. If either the diet or oral hygiene is still of concern or other risk factors remain, continuation of the fluoride supplement and other therapies is indicated.

Rampant Caries Management

With increasing frequency, new patients present to the clinic with extensive dental caries, often complaining of pain. In these cases it is not unusual to learn it has been many years since the patient's last dental visit and that the patient only seeks care when in pain. In addition to the situation described above, dentists have a number of patients of record who only seek dental care when in pain yet have multiple areas of dental decay.

The first priority of the examining dentist is to address pathology that is causing discomfort. This may take the form of extraction of hopeless teeth, endodontic therapy or decay removal from the offending tooth with the placement of a suitable temporary filling material. It is important to assess the patient's understanding of their oral condition by asking if they know what is causing their pain and what they can do to address the disease condition. This is also an appropriate time to ask the patient their view of the importance of oral health and what they would like dentists to do for them.

After addressing the patient's chief complaint, the treating dentist should determine if the patient has an interest in addressing their oral health care needs. If the patient expresses interest, a complete inventory of dental caries by tooth and surface needs to be made as well as a complete periodontal assessment.

Periodontal concerns are addressed by gross debridement and extraction of hopeless teeth. A thorough review of the patient's medical history may shed light on factors that are contributing to the disease process. For example, diabetes may be a cause of the patient's periodontal problems or the patient may be on a medication that is causing xerostomia contributing to rampant caries.

Patients with extensive dental disease are often non-compliant with attendance at scheduled dental appointments and in making the behavior and lifestyle changes necessary to maintain a healthy dentition. Prochaska's Behavior-Change Model (see Appendix 4 in the original guideline document) is a useful tool to assess the patient's willingness to make the changes required for improved oral health, including regular dental visits.

Patient education about the dental disease process is a vital element of the initial comprehensive assessment. The chances for a successful outcome

of dental care improve when the patient is engaged as an active participant in their care. The patient must take ownership of their oral condition, not the dentist, if long term success is to be expected.

Dental caries is a bacterial infection with diet playing a significant role. There is a growing body of evidence suggesting that caries is a polymicrobial phenomenon. Diet modification is also critical in controlling rampant caries. In addition to asking about sugared foods, the dental professional also needs to explore frequency of eating and types of beverages consumed. In order to control the active caries, it may be necessary to schedule the patient in a manner that allows gross decay removal from a number of teeth at a single appointment and the placement of a temporary restoration such as glass ionomer. Glass ionomers offer a number of advantages as a temporary material including the ability to bond to tooth structure and the release of fluoride. The appointments should allow the maximum number of teeth to be treated (temporized) each visit. This may involve scheduling by quadrant, by arch or by half mouth. In addition to gross decay removal, the dentist should seal unaffected grooves and pits that can serve as a reservoir for decay causing bacteria.

Prior to embarking on a series of appointments designed to eradicate decay and temporize teeth, a candid assessment needs to be made of the long term viability of the teeth and the patient's willingness to invest the time, money and effort to maintain them. In the long run, it may be more prudent to extract marginal teeth rather than attempt heroic efforts that ultimately result in failure and wasted resources.

There is a natural and understandable tendency on the part of the restoring dentist to want to place permanent restorations in the highly active caries patient at the restorative visit. It is important to recognize that this clinical condition developed over a long period of neglect. Placing glass ionomer restorations using a non-traumatic technique can build the dentist-patient rapport while also addressing the patient's active caries state and enhancing their self-esteem through improved esthetics. Patients with deep decay may become alienated if they experience significant pre and postoperative pain associated with deep restorations or pulpal involvement. Also, glass ionomer temporaries can improve gingival health prior to placement of permanent restorations.

Consider the sequence of treatment carefully. The presence of decay in the front teeth may motivate patients that they need to be faithful to their dental appointments, especially in situations where concerns exist. Patients need to be informed of the sequence of care that is planned.

The next step in the treatment of the severely decay challenged patient is the use of short term antimicrobial agents. Fluoride varnishes have been shown to be highly effective as antibacterial agents. Fluoride varnishes are particularly effective for patients with exposed root surfaces. Application of fluoride varnish to the highly caries active patient at each recall and restorative visit is a very cost effective method (from both a time and materials perspective) in the quest to control decay activity.

An additional treatment is short term use of CHX mouth rinse. CHX is effective against MS. The patient should be instructed to rinse for 30 seconds with ½ oz. of CHX twice daily. A 2 week course of CHX every 3 months assists in controlling the level of MS.

A phenomenon encountered with increasing frequency is the young patient presenting for examination with numerous enamel caries without cavitation. Most often the etiology is diet related and patient education is critical. This clinical situation is the precursor to the patient described above and requires the same attention to interventions and recall frequency.

OTC fluoride rinses and prescription fluoride toothpastes have been shown to be effective in remineralizing tooth structure. Low dose, frequent exposures to fluoride should be recommended to foster an oral environment that promotes tooth remineralization.

Patients being treated for extensive caries need to be placed on a frequent caries recall protocol. The caries re-exam appointment (code 0120C) provides a useful model to follow. At each recall, necessary radiographs are taken to evaluate for new decay and remineralization of previously diagnosed lesions. An exam is conducted for new areas of decay and failing restorations. This appointment is an ideal opportunity to apply fluoride varnish to exposed root surfaces and other areas that seem vulnerable to new decay.

Once the patient has demonstrated the willingness to attend dental appointments and to engage in the homecare necessary to maintain his/her dentition, permanent restorations can be placed in the temporized teeth. Once the temporized teeth have been permanently restored the patient enters the maintenance phase of care.

Root Surface Caries

As the patient population ages and retains their natural dentition, root surface caries is becoming more prevalent. It is projected that by the year 2020 the geriatric component of the U.S. population aged 64 years and older will comprise approximately 20 percent of the total population.

The primary risk factor for root surface caries for people in the 65+ age group is periodontal disease and gingival recession. Reduced physical dexterity limits the ability of the patient to remove the plaque. The cementoenamel junction (CEJ) is often the initial site of root surface decay. The mandibular premolars and molars as well as the maxillary canines are frequently involved.

Correct diagnosis is the first step in treating a root surface lesion. In addition to caries etiology, lesions may be classified as abrasion (a mechanical removal of root structure), erosion (chemical removal of root structure), and idiopathic root resorption or root surface caries (RSC). Active RSC presents as yellow or light brown in color and is relatively soft to the explorer. Due to soft nature of cementum, the explorer should not be used aggressively when examining a root surface lesion.

Remineralization is the treatment of choice whenever possible and fluoride is the most effective agent available to accomplish this. Arrested lesions become dark brown to black in color and are hard enough to resist penetration by the explorer. They are generally shiny in color.

The Root Surface Caries Severity Index

The Root Surface Caries Severity Index (see Figure 5 in the original guideline document) classifies root caries into 4 grades:

- Grade I is the incipient lesion treatable by polishing the surface followed by daily application of 1% sodium fluoride gel.
- Grade II lesions are shallow (<.5 mm) and are treated by recontouring and polishing the surface defect and daily application of fluoride as described above.
- Grade III lesions are deeper than .5 mm and require restoration. Consideration should be given to a restorative material that is capable of bonding to dentin and cementum and offers the benefit of continuous fluoride release. Glass ionomer is the first choice for restorative material, amalgam is the second choice followed by composites.
- Grade IV lesions are deep lesions involving the pulp. Treatment may involve pulpal therapy followed by a restoration or extraction.

Interventions

See Appendix 1 in the original guideline document for information and guidance concerning specific interventions.

Clinical Algorithm(s)

The following algorithms are provided in the original guideline document:

- Primary and transitional dentition
- Remineralization flow chart

Scope

Disease/Condition(s)

Dental caries

Guideline Category

Diagnosis

Evaluation

Management

Prevention

Risk Assessment

Treatment

Clinical Specialty

Dentistry

Intended Users

Dentists

Guideline Objective(s)

- To significantly reduce the incidence of caries in the HealthPartners Dental Group's patient population
- To provide a systematic approach to assess the individual's risk of developing caries, and to provide evidence-based interventions that reduce that risk with the ultimate goal of preservation of tooth structure

Target Population

HealthPartners Dental Group patients

Interventions and Practices Considered

Diagnosis/Evaluation/Risk Assessment

1. Oral assessment and assignment of risk of developing dental caries
2. Radiologic and clinical examination
3. Emerging diagnostic techniques:
    - Fluorescence
    - Fiber-optic transillumination (FOTI)
    - Digitally imaging fiber-optic transillumination (DIFOTI)
    - Electrical conductivity
4. Monitoring of patient compliance with lifestyle changes and interventions

Prevention/Management/Treatment

1. Remineralization therapy:
    - Fluoride therapy (gels, toothpaste, varnishes, rinses, sealants)
    - Diet modification
    - Chlorhexidine (CHX)
    - Xylitol
    - Casein phosphopeptide-amorphous calcium phosphate (CPP-ACP)
2. Rampant caries management:
    - Gross debridement
    - Extraction
    - Glass ionomer
    - Amalgam
    - Short term antimicrobial agents
3. Patient education on lifestyle changes for risk reduction

Major Outcomes Considered

- Incidence of new caries
- Patient population per caries risk
- Effectiveness of treatment

Methodology

Methods Used to Collect/Select the Evid

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

PubMed search on dental caries risk assessment (original search was performed in 2008).

Search terms used were:

- "dental caries"[majr:noexp] OR caries[ti]
- #1 AND ("risk assessment"[tw] OR (risk[ti] AND assess*[ti]))

Filters set on this retrieval: Publication date from January 1, 2008 to December 13, 2013; also English[language].

An expert committee was convened to review the currency of the guideline(s). Committee members met numerous times in 2013 and reviewed and discussed relevant articles published within the last five years.

Number of Source Documents

Retrieval was 197 citations; after editing out irrelevant papers, final set was 96 articles.

Methods Used to Assess the Quality and Strength of the Evidence

Not stated

Rating Scheme for the Strength of the Evidence

Not applicable

Methods Used to Analyze the Evidence

Review

Review of Published Meta-Analyses

Description of the Methods Used to Analyze the Evidence

Committee members reviewed and discussed relevant articles published within the last five years.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

Not stated

Rating Scheme for the Strength of the Recommendations

Not applicable

Cost Analysis

The guideline developers reviewed published cost analysis.

Method of Guideline Validation

Not stated

Description of Method of Guideline Validation

Not applicable

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of evidence supporting the recommendations is not specifically stated.

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate assessment, management and prevention of dental caries

Potential Harms

- Side effects of chlorhexidine (CHX) include:
  - Staining of teeth and restorations
  - Increased calculus deposits
  - Approximately 11% alcohol
- Xylitol may cause loose stools in some patients. The side effects usually occur at higher dosages and subside once xylitol consumption ceases. To minimize the side effects, xylitol should be introduced slowly, over a week or more, to acclimate the body to the polyol, especially in younger children.
- Stannous fluoride (SnF, found in fluoride gels) can cause staining and the taste may be objectionable to some.
- Sealants require regular inspection and maintenance. A partially lost sealant can be more plaque retentive and at the same caries risk of an unsealed surface. Technique is critical, as a poorly placed sealant is a caries risk liability.
- Electrical conductivity tools have been developed for clinical use to detect occlusal caries. They show high sensitivity but low specificity resulting in significant risk of over treating.
- Children aged <6 years should not use fluoridated mouth rinses without prior consultation with their dentist, because dental fluorosis could occur if swallowed repeatedly.
- Fluorescence systems have good positive predictive value (PPV) and negative predictive value (NPV) in high risk populations, but unacceptably large numbers of false positives are possible in moderate and low risk populations.

Contraindications

Contraindications

- Casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) is contraindicated for patients who have allergies to milk proteins.
- High-fluoride toothpaste is contraindicated for children ages <6 years because of their increased risk of fluorosis.
- A prophylaxis prior to application of a topical fluoride is not necessary. In most circumstances the use of prophylaxis paste is contraindicated as it removes the fluoride-rich outer layer of enamel.
- Acidulated phosphate fluoride (APF) is not recommended for patients with porcelain or composite restoration as they may become etched.

Qualifying Statements

Qualifying Statements

The radiographic examination recommendations presented are based on the U.S Food and Drug Administration (FDA) recommendations found in Guidelines for Prescribing Dental Radiographs (see Appendix 2 in the original guideline document). This guideline was developed by a panel of experts to optimize patient care by presenting patient selection criteria based on signs, symptoms, and history of the individual patient, rather than using the "routine" intervals that have historically been the norm for prescribing dental radiographs. The recommendations are meant only as a guide and may be customized by the dentist to satisfy the individual needs of the patient in a given situation. As an example, specific monitoring of an early carious lesion would be appropriate at other intervals.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Chart Documentation/Checklists/Forms

Clinical Algorithm

Resources

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Staying Healthy

IOM Domain

Effectiveness

Patient-centeredness

Identifying Information and Availability

Bibliographic Source(s)

HealthPartners Dental Group and Clinics caries guideline. Minneapolis (MN): HealthPartners Dental Group; 2013 Dec. 69 p. [374 references]

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2008 Mar 31 (revised 2013 Dec)

Guideline Developer(s)

HealthPartners Dental Group - Professional Association

Source(s) of Funding

HealthPartners Dental Group

Guideline Committee

Not stated

Composition of Group That Authored the Guideline

Not stated

Financial Disclosures/Conflicts of Interest

Not stated

Guideline Status

This is the current release of the guideline.

This guideline updates a previous version: HealthPartners Dental Group and Clinics caries guideline. Minneapolis (MN): HealthPartners Dental Group; 2008 Mar 31. 60 p. [328 references]

Guideline Availability

Electronic copies: None available

Print copies: Available from HealthPartners, 8170 33rd Avenue South, P.O. Box 1309, Minneapolis, MN 55440-1309; Phone: (952)883-5151; Web site: http://www.healthpartners.com.

Availability of Companion Documents

Checklists for primary, transitional and permanent dentition are provided in the original guideline document.

In addition, the following information is provided in Appendices 2-5 in the original guideline document:

- Information concerning motivational interviewing
- Guideline for prescribing dental radiographs chart
- Summary of Prochaska's behavior change model for caregiver use
- Personal dental care report (PDCR) example

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on October 16, 2008. The information was verified by the guideline developer on October 27, 2008. This NGC summary was updated by ECRI Institute on March 6, 2014. The updated information was verified by the guideline developer on April 2, 2014.

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